

Landscape-Scale Carbon Emissions from Historically Harvested Forest Products

Sean Healey, PhD
Interior West Forest Inventory and Analysis

Todd A. Morgan, CF
Bureau of Business & Economic Research

October 19, 2009

Forest Industry Censuses

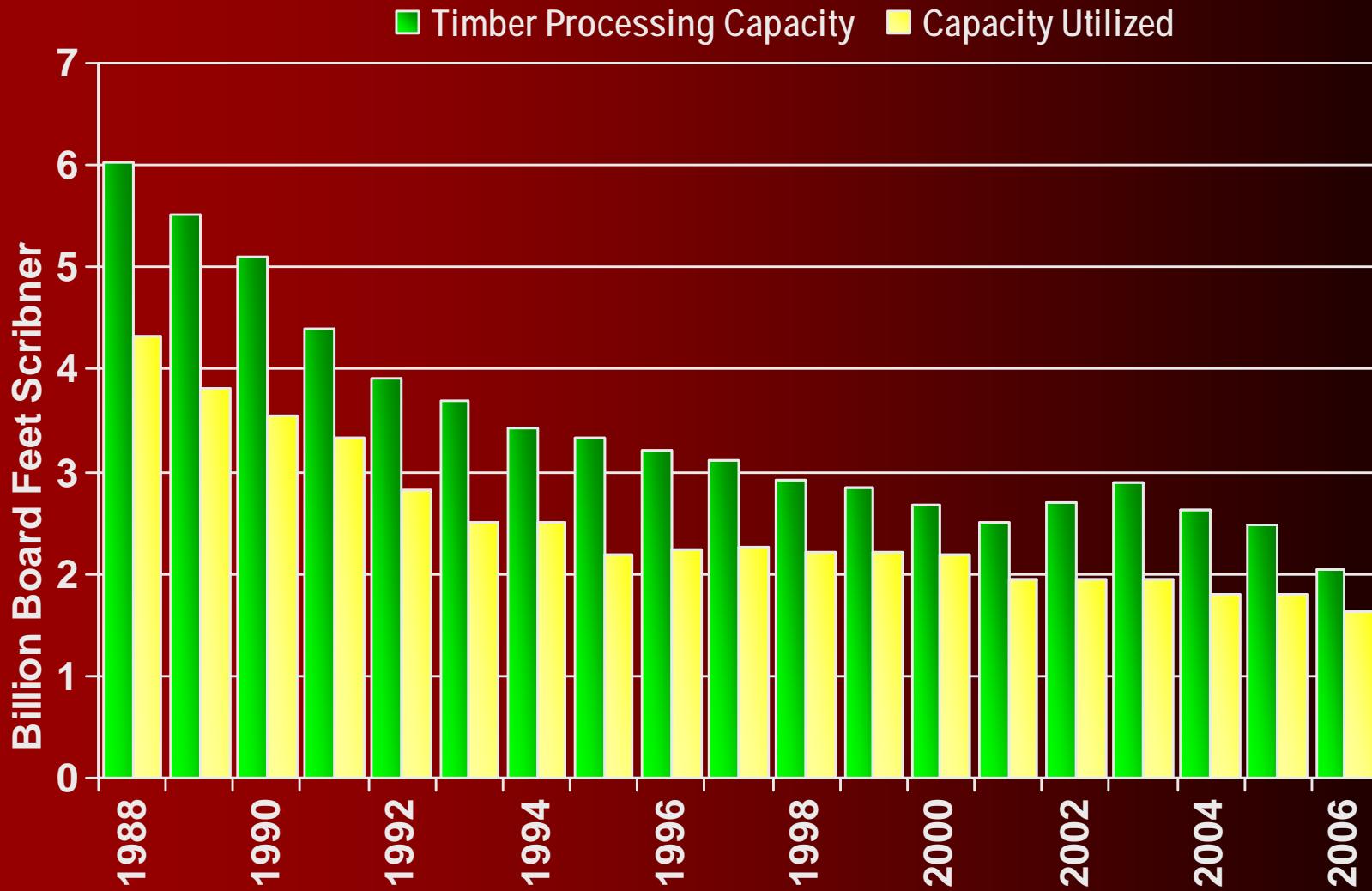
- Mill type, capacity, equipment, employment
- Timber harvest volume, use, species, county, & ownership
- Product volume, sales, & geographic distribution
- Mill residue & wood fiber use

California's Forest Products Industry



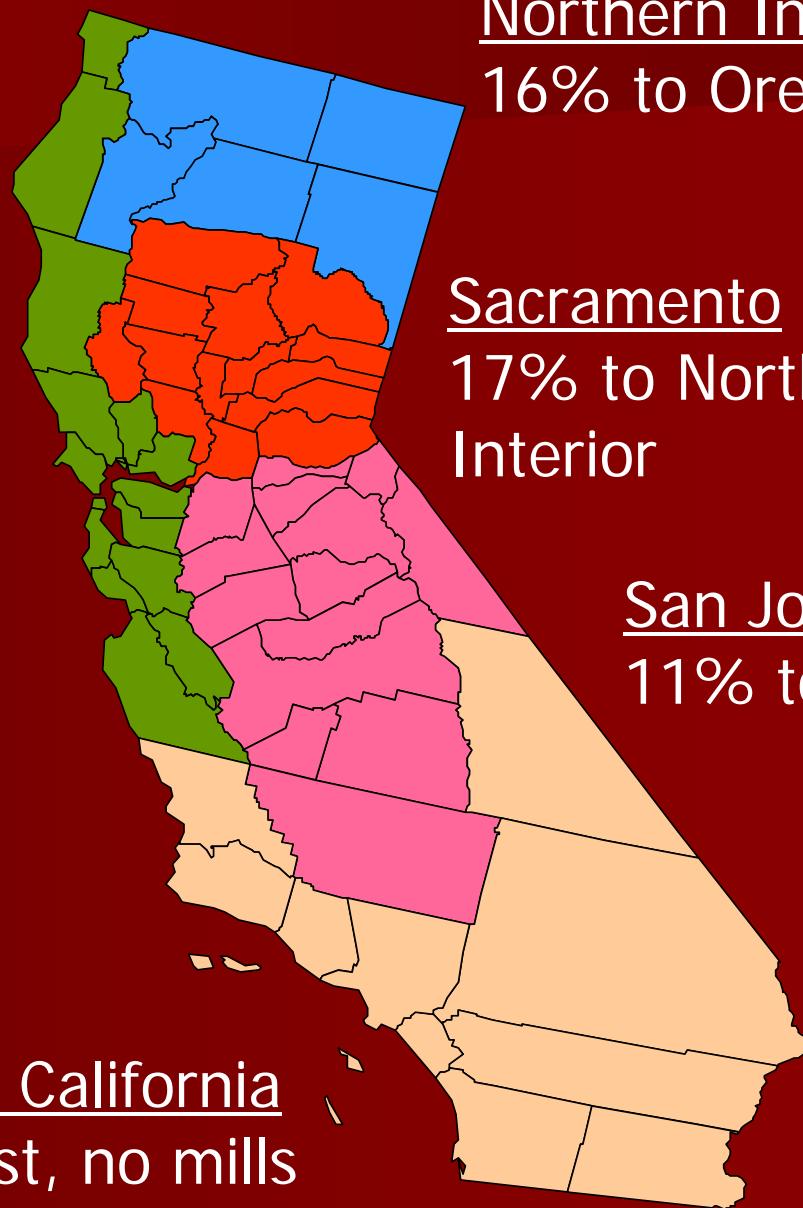
California's Timber-Processing Capacity & Use

(excluding pulpwood)



Percent of harvest processed in-area

Coastal 94%
4% to Northern
Interior



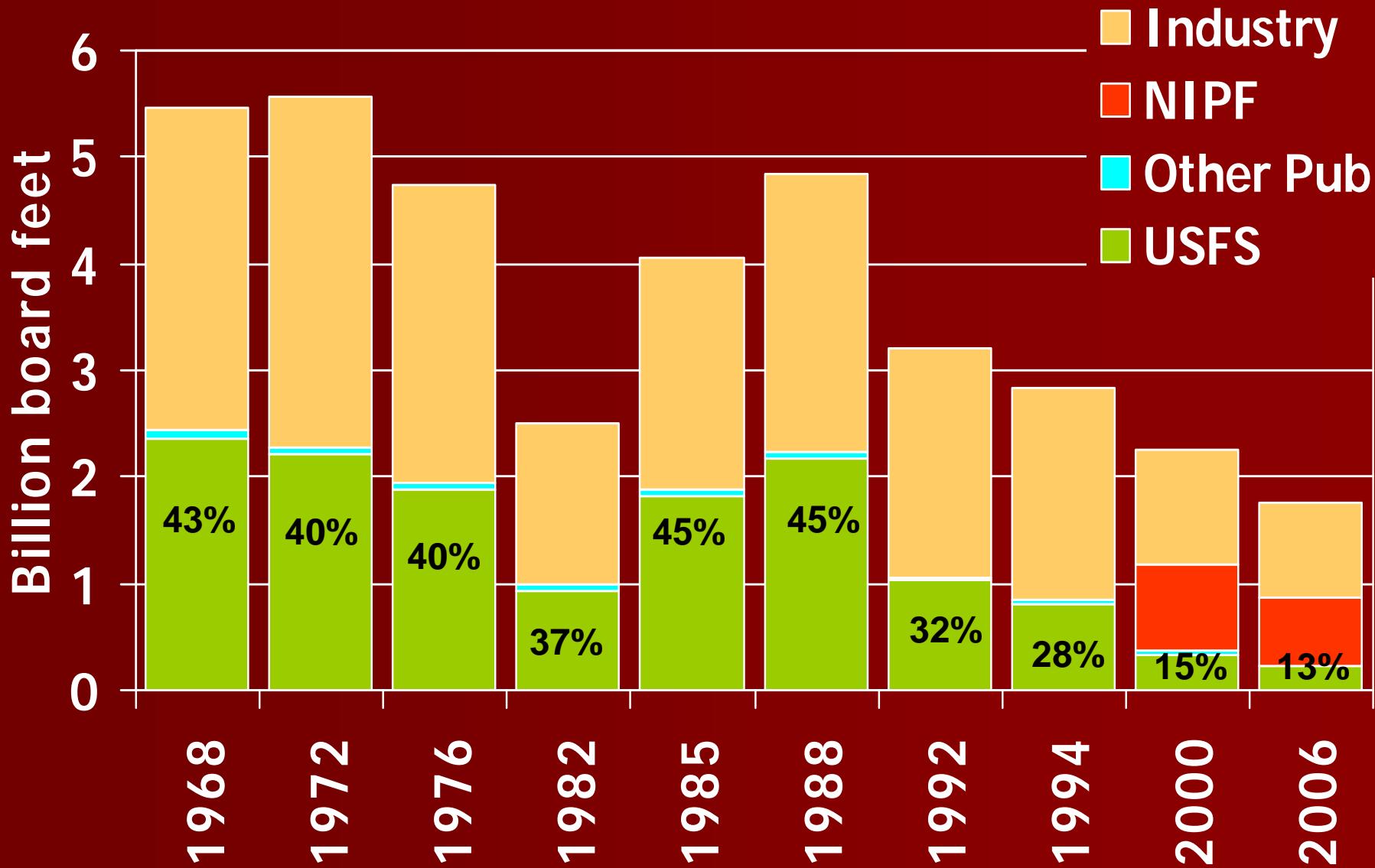
Northern Interior 79%
16% to Oregon

Sacramento 77%
17% to Northern
Interior

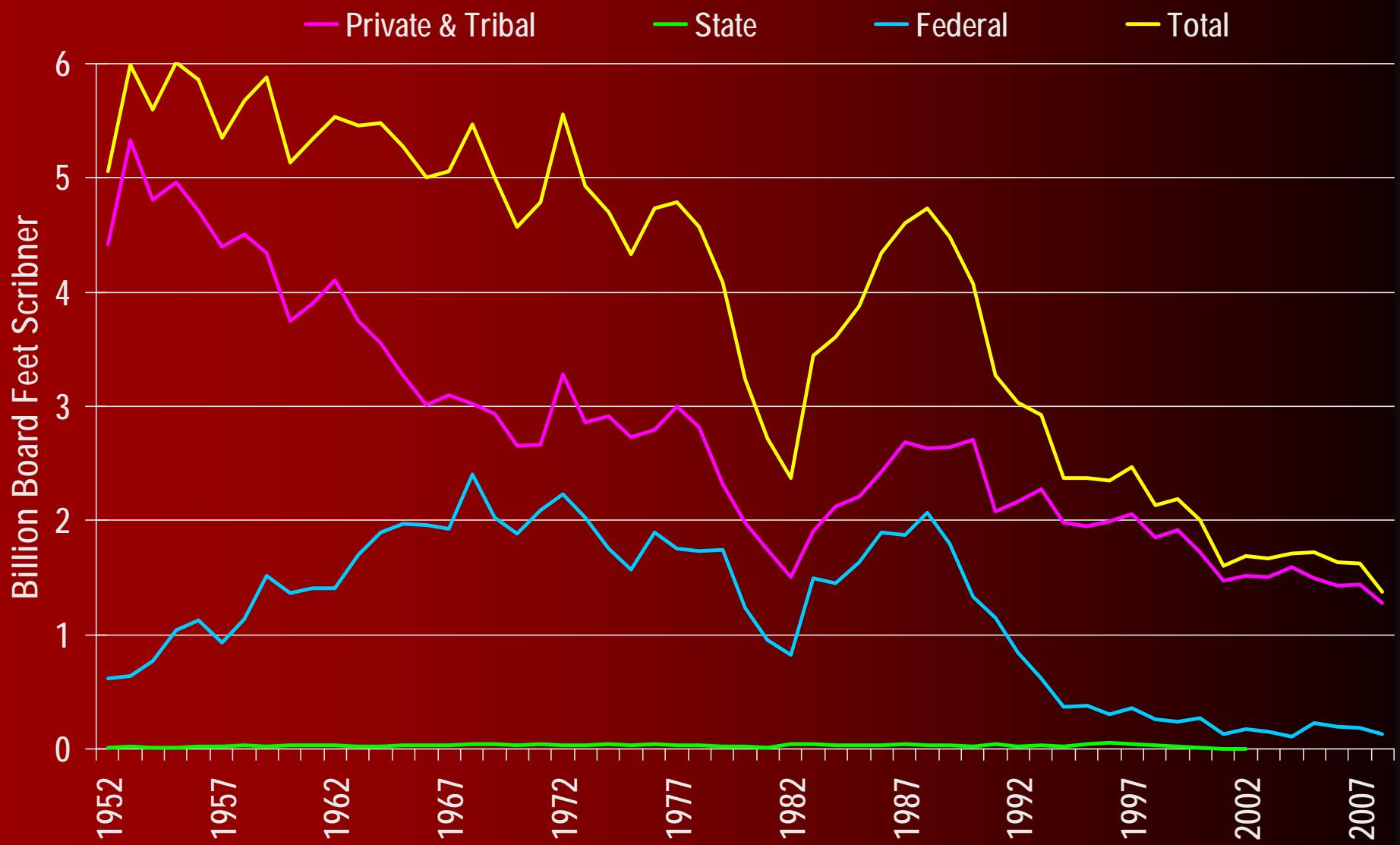
San Joaquin 89%
11% to Sacramento

Southern California
no harvest, no mills

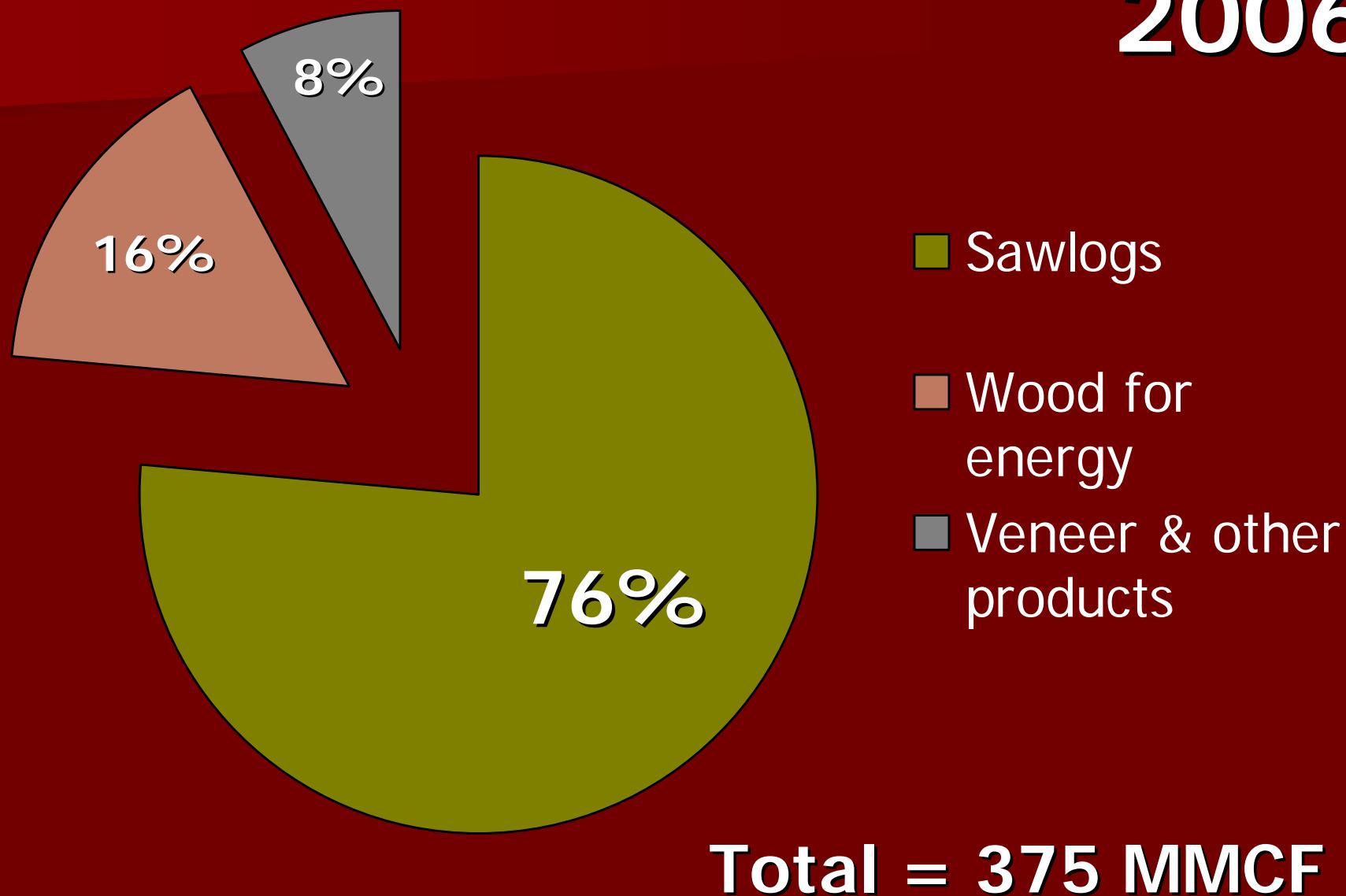
California Timber Harvest



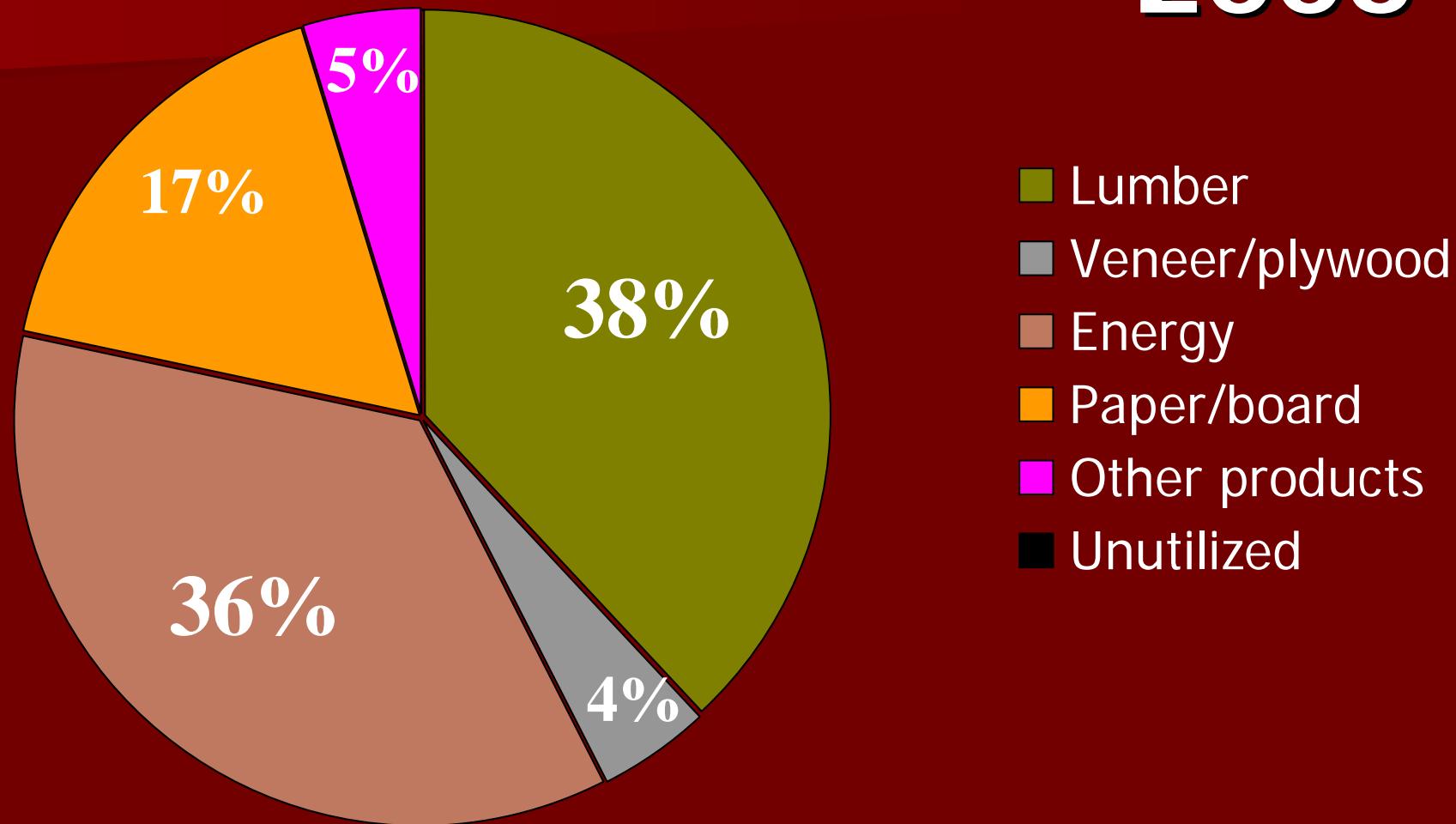
California Annual Timber Harvest 1952-2008



California Timber Harvest, 2006



Disposition of Wood Fiber, 2006



Total = 375 MMCF

Logging Utilization



What BBER can readily provide

- In-state timber harvest info.
- In-state timber-processing info.
- Historic timber harvest & wood industry info.
- Logging residue info.

What BBER cannot readily provide, but may be able to help with

- Total in-state consumption of wood products
- Detailed international log or product import/export info.
- Energy consumption associated with wood products manufacturing, transportation, sales, etc.
- Quantities, types, and fate of non-wood by-products
- In-state secondary wood products manufacturing
 - Volumes and sources of wood inputs
 - Volume and disposition of wood residues
- Fate of wood products consumed in-state

Carbon Project



Determining Landscape-Scale Carbon Emissions from Historically Harvested Forest Products

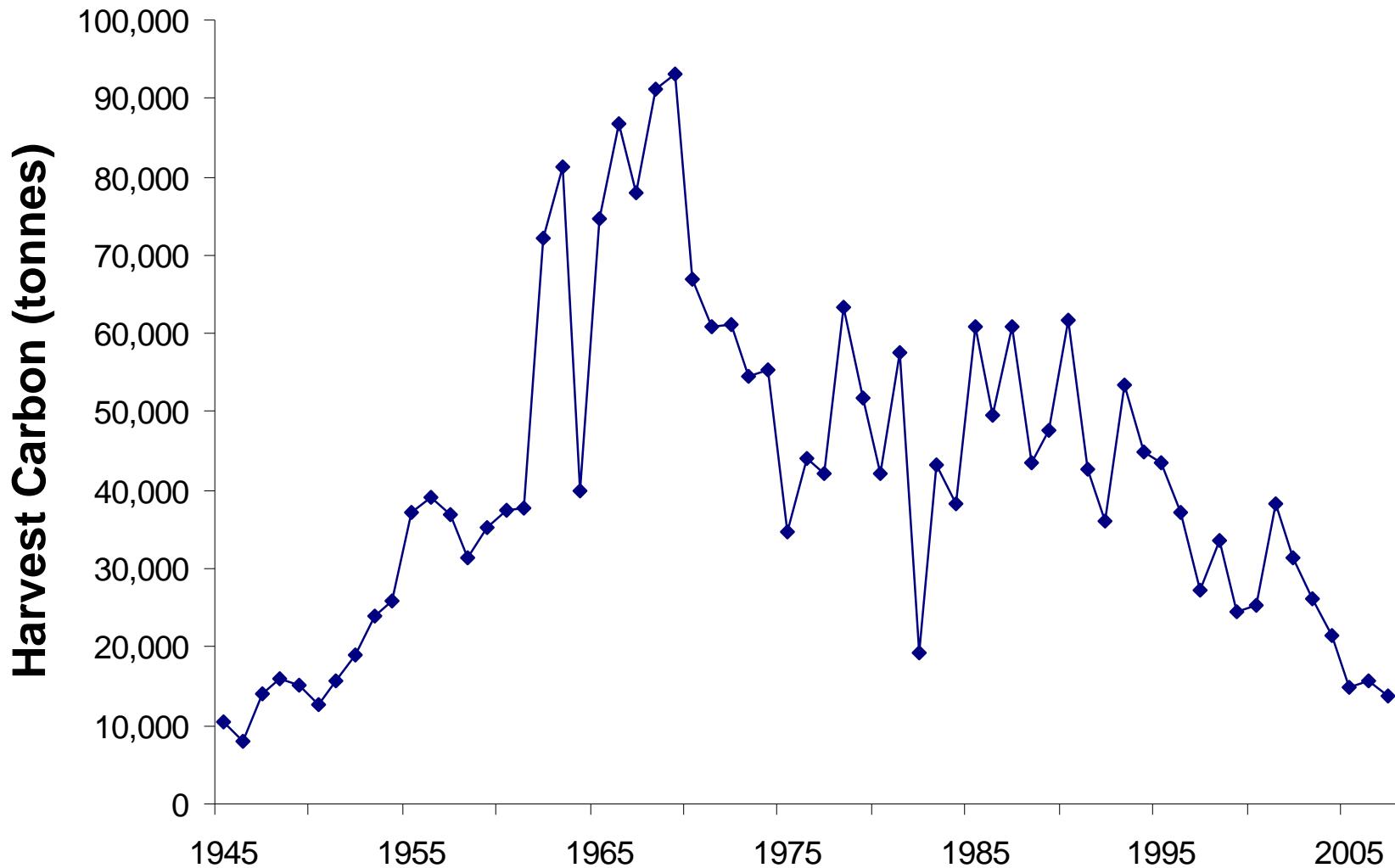
Todd Morgan

Bureau of Business and Economic
Research
University of Montana

Sean Healey

Forest Service – Rocky Mountain
Research Station
Ogden, UT

Carbon in Wood Products Harvested from Ravalli County, MT, 1945-2007



Mass of carbon comes from administrative harvest volume records, transformed from board feet to cubic feet using TPO survey data and further translated to carbon using conversion factors in Skog and Nicholson (2000).

Disposal, decay, and energy recapture dynamics drawn from the carbon offset literature can be implemented in a spreadsheet-based tracking system for harvested wood carbon

Year after production	Pacific Southwest, Softwood				
	All	In use	Landfill	Energy	Emitted without energy
0	0.181	0.675	0.000	0.170	0.156
1	0.193	0.637	0.018	0.180	0.166
2	0.204	0.602	0.034	0.189	0.175
3	0.213	0.572	0.048	0.197	0.183
4	0.221	0.545	0.061	0.204	0.191
5	0.229	0.521	0.072	0.210	0.197
6	0.235	0.498	0.082	0.216	0.204
7	0.241	0.478	0.092	0.221	0.209
8	0.247	0.458	0.101	0.226	0.215
9	0.252	0.440	0.109	0.231	0.220
10	0.257	0.424	0.116	0.235	0.225
15	0.275	0.363	0.143	0.250	0.243
20	0.285	0.323	0.161	0.260	0.257
25	0.294	0.292	0.173	0.268	0.267
30	0.301	0.266	0.183	0.273	0.277
35	0.306	0.245	0.192	0.278	0.285
40	0.312	0.226	0.198	0.282	0.293
45	0.316	0.210	0.204	0.285	0.300
50	0.320	0.196	0.210	0.288	0.306
55	0.324	0.184	0.214	0.290	0.312
60	0.327	0.173	0.218	0.292	0.317
65	0.330	0.162	0.222	0.293	0.322
70	0.333	0.153	0.226	0.294	0.327
75	0.336	0.145	0.229	0.295	0.331
80	0.338	0.137	0.232	0.296	0.335
85	0.340	0.130	0.235	0.296	0.339
90	0.342	0.124	0.238	0.296	0.343
95	0.344	0.117	0.240	0.296	0.346
100	0.345	0.112	0.243	0.296	0.349

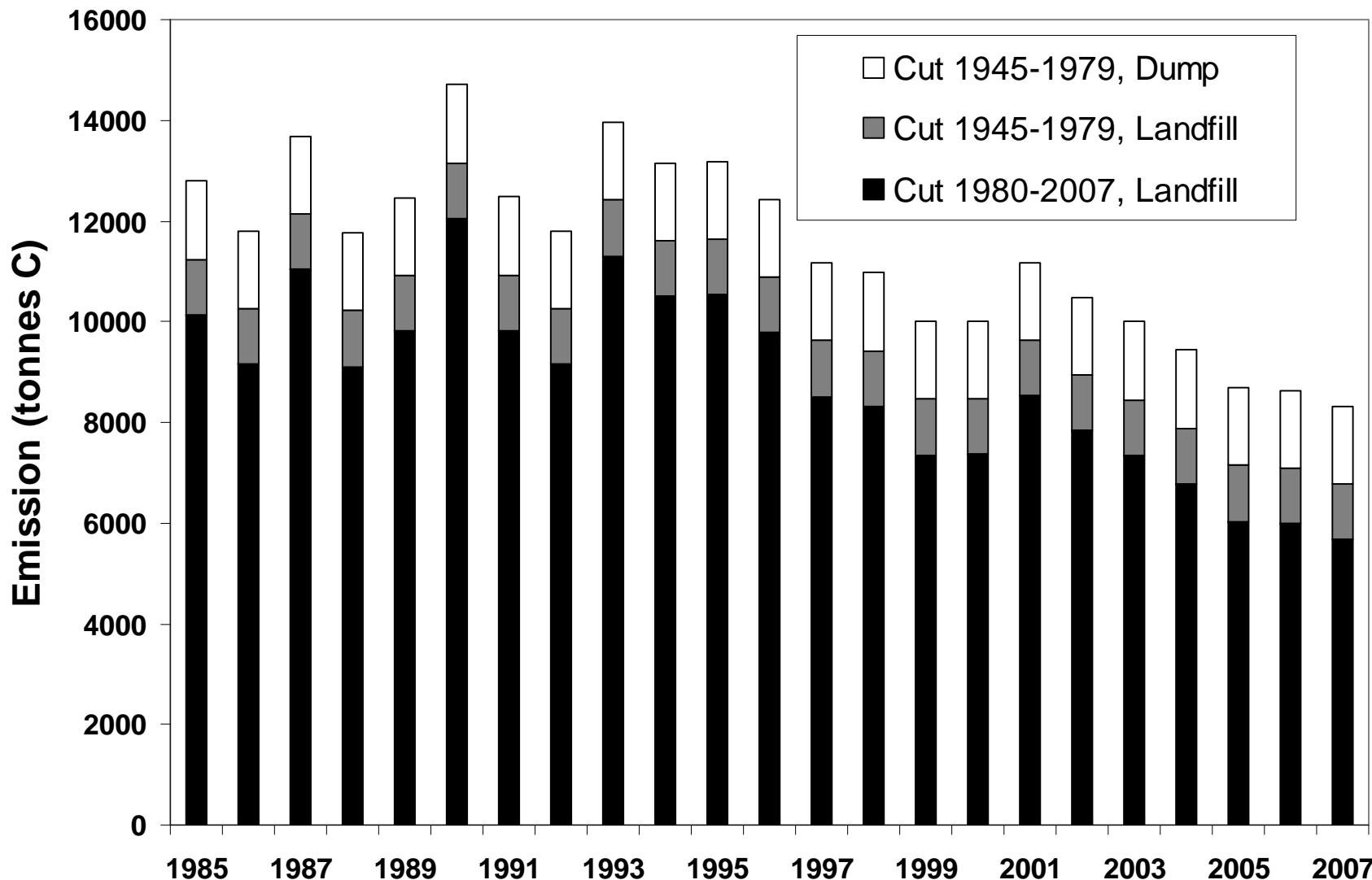
From: Smith, Health, Skog, and Birdsey, 2006.

See:

www.treesearch.fs.fed.us/pubs/22954

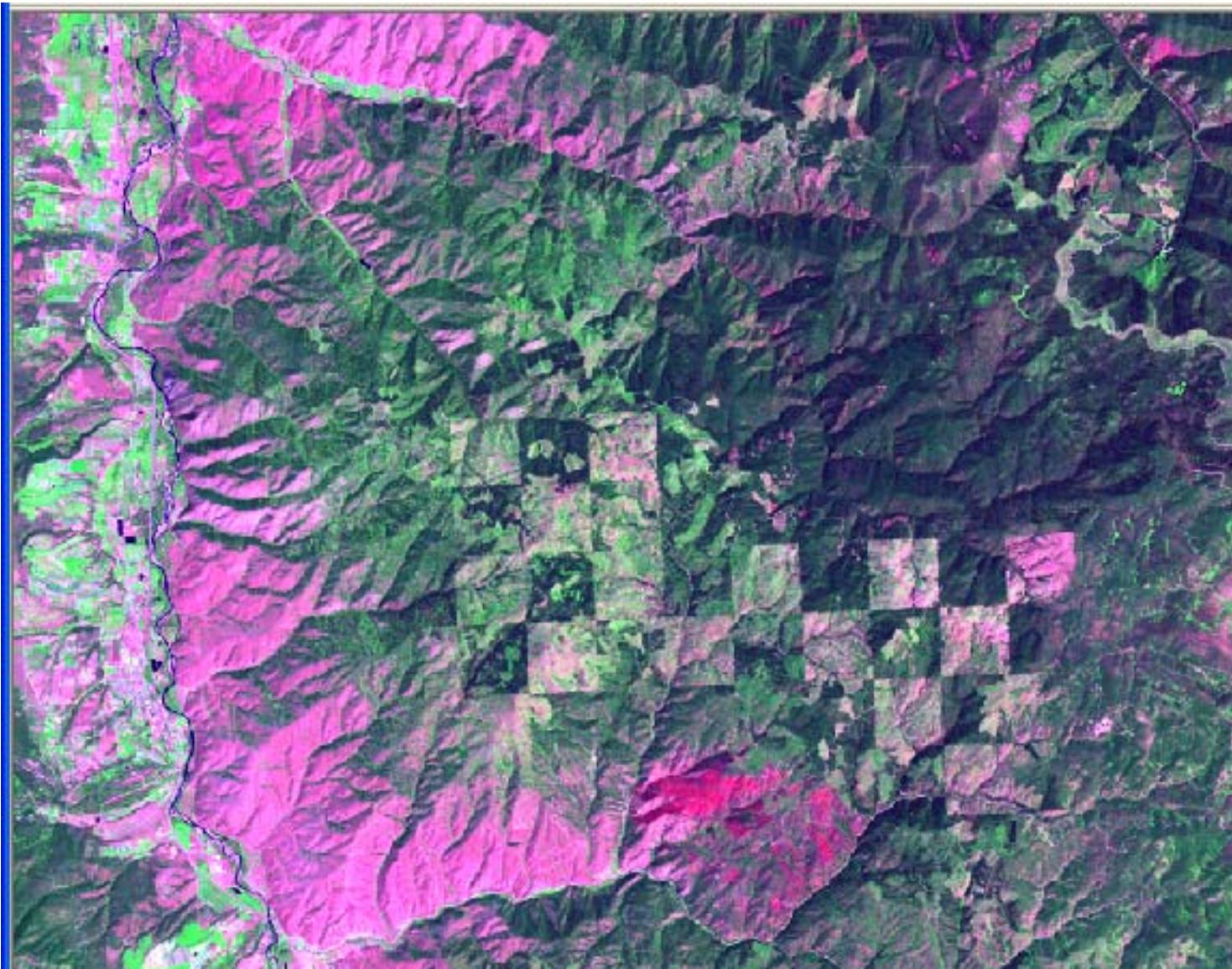
Harvested forest carbon is “tracked” first to disposal (below) and ultimately to emission either via decay or through energy recapture using dynamics in the offset literature.

Annual product carbon emissions may be derived that realistically include historically harvested forest products

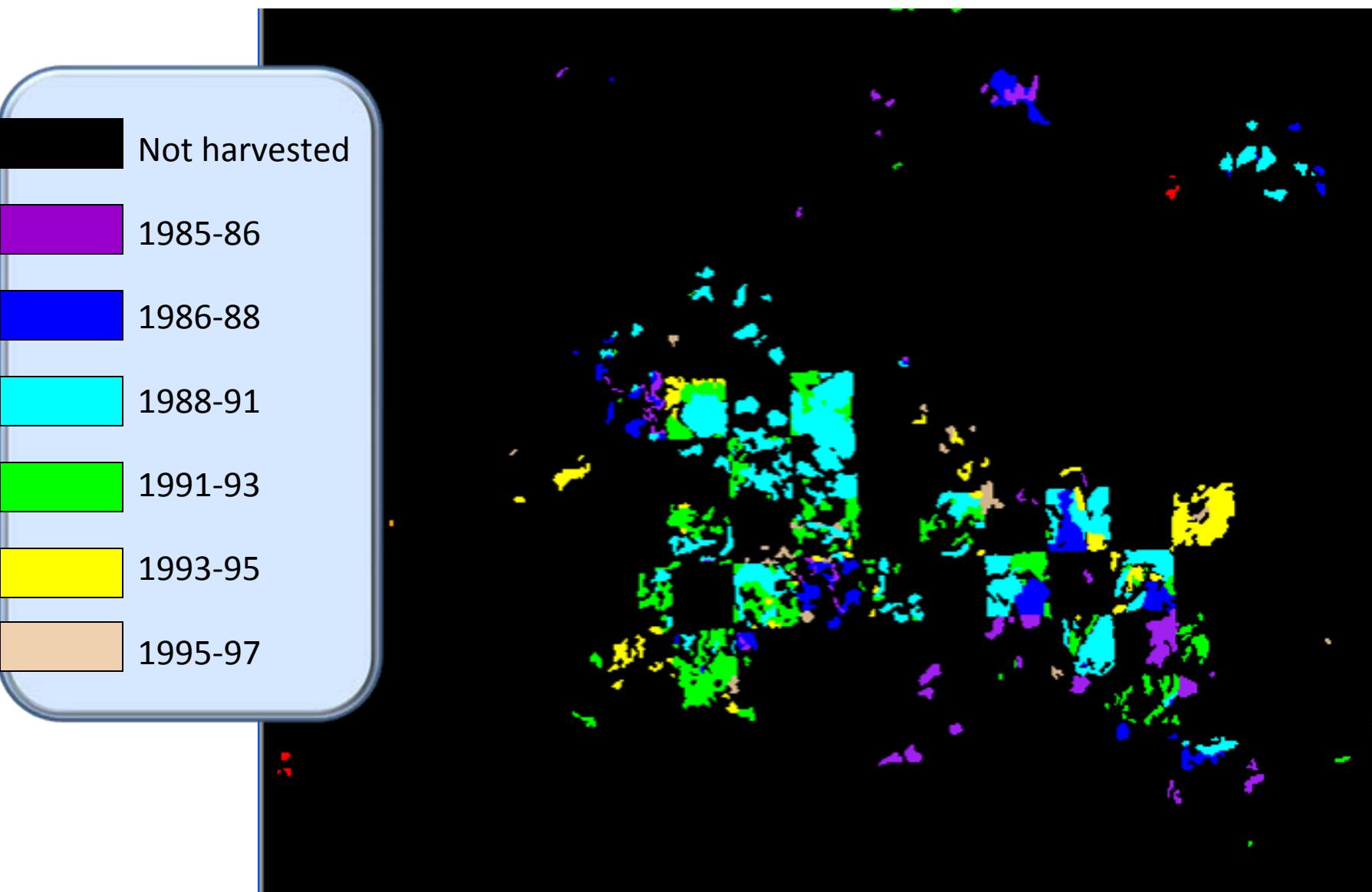


More on this method: <http://www.treesearch.fs.fed.us/pubs/33355>

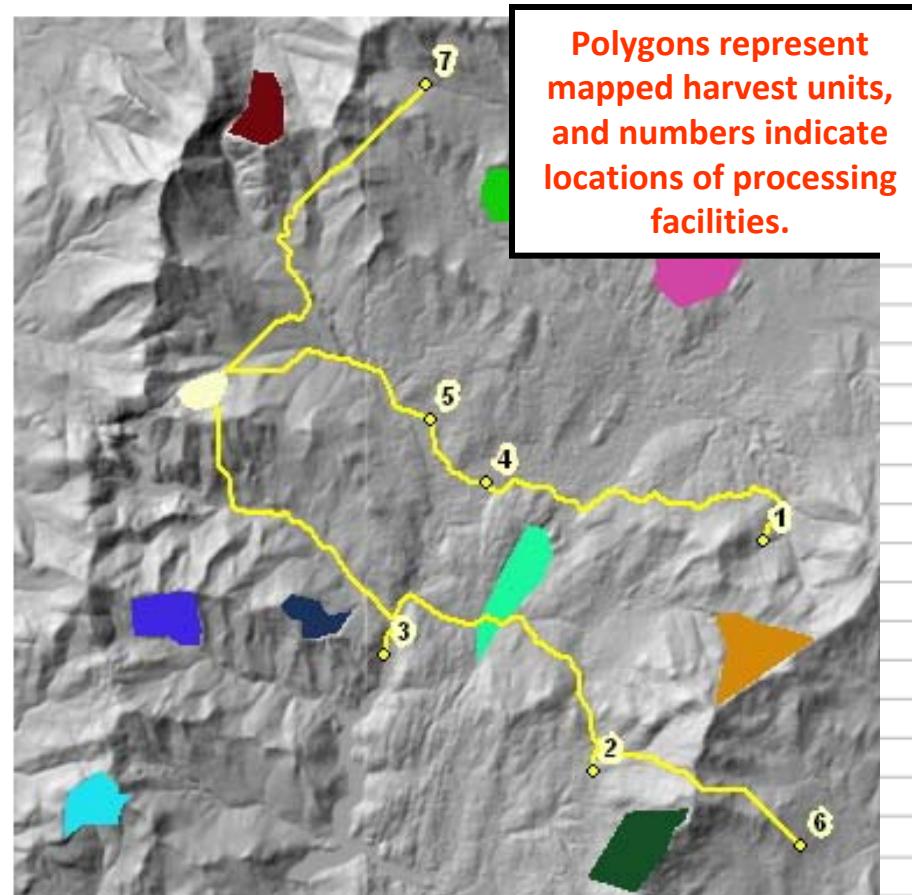
We can also combine the TPO mill data with satellite-derived maps of harvest to estimate timber haul distances and fossil carbon emissions.



We can use Landsat satellite time series to determine the spatial and temporal distribution of most harvests.



Within a GIS, we can estimate the road distance between each harvest and each mill. Then, we run a lot of simulations that “send” timber from particular harvests to particular mill to derive...

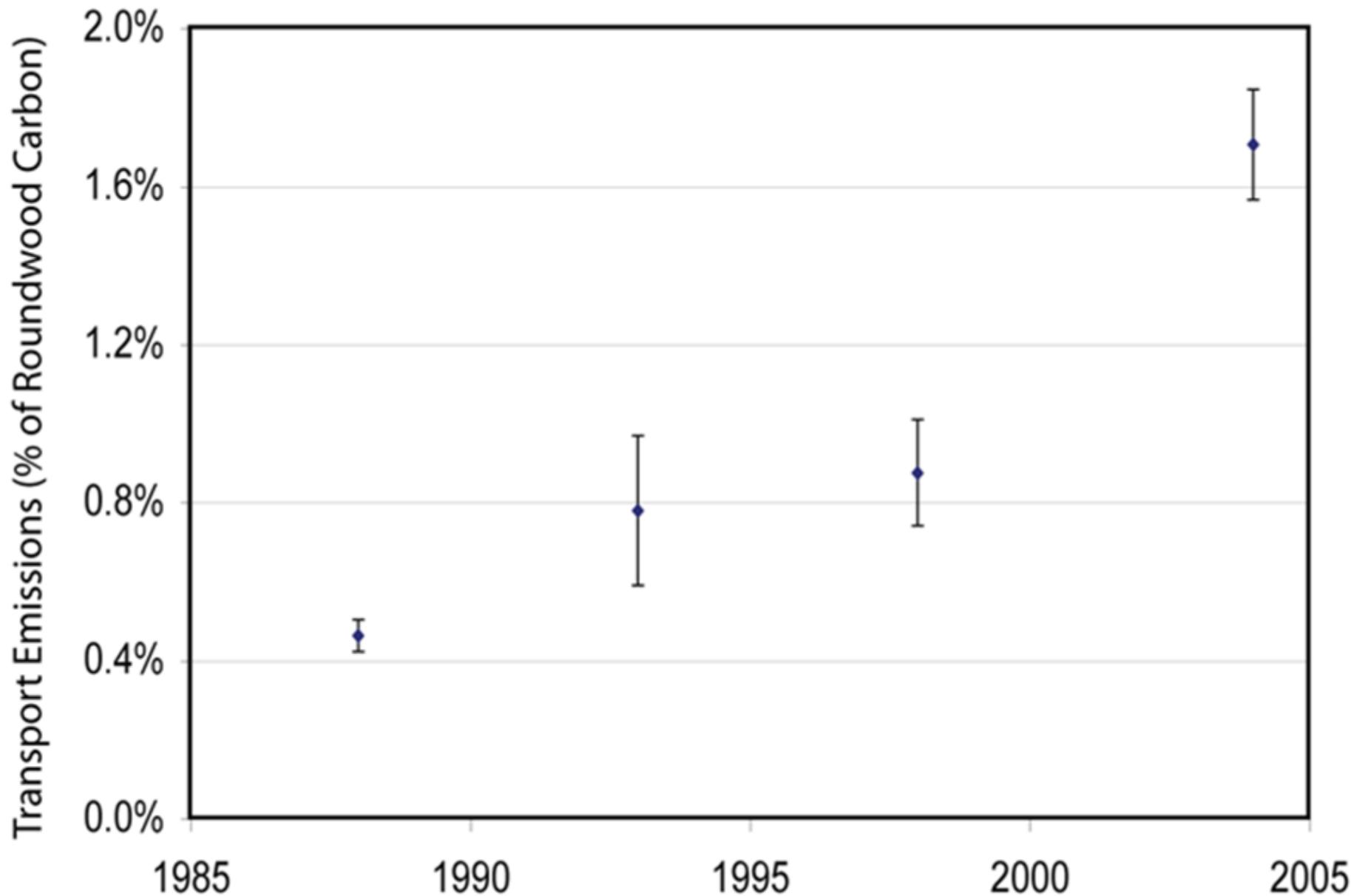


Harvest to Mill Shortest Path Example

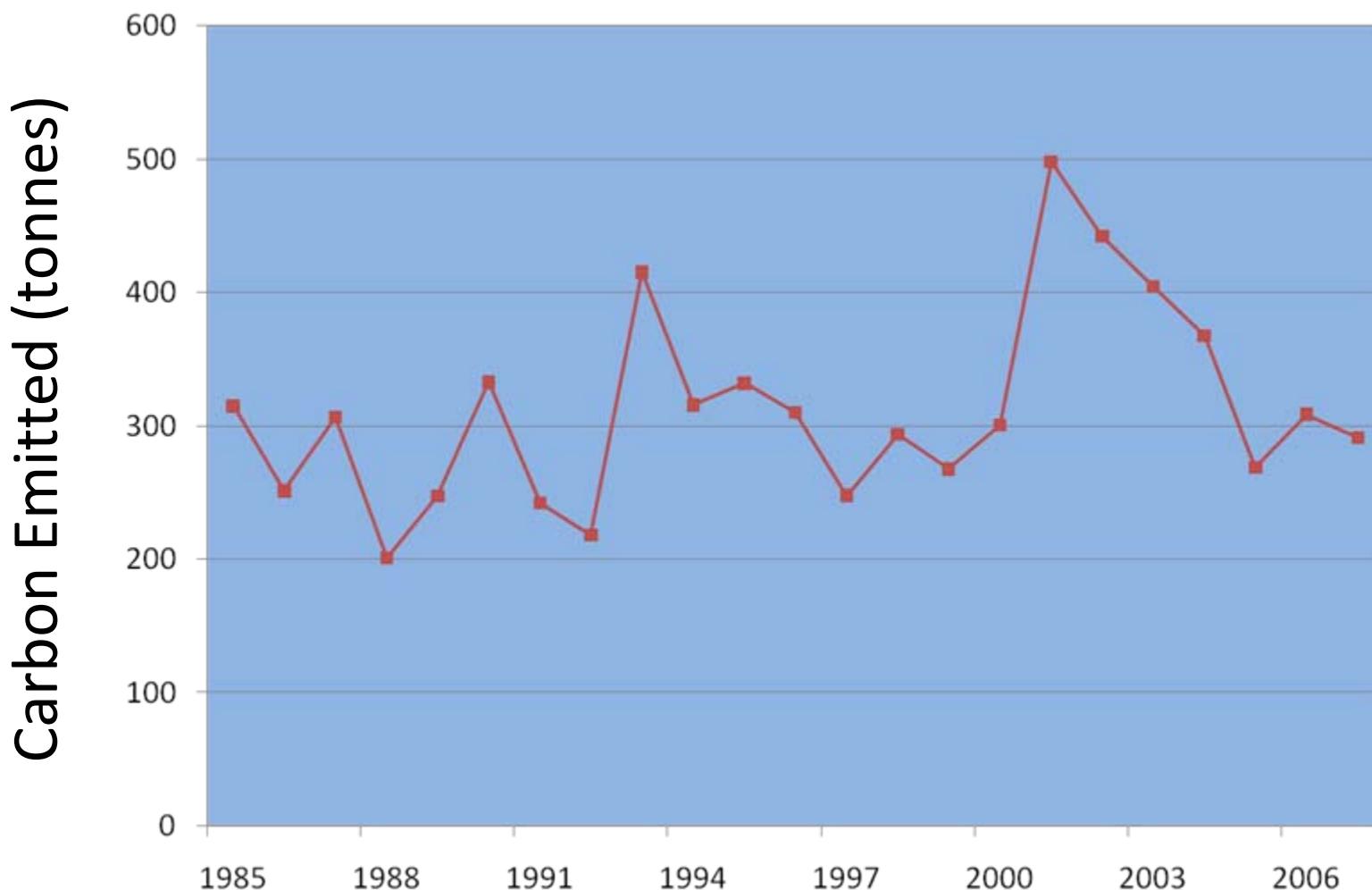
note: distance in meters

HARVEST	MILL LOCATION						
	1	2	3	4	5	6	7
1	18,863	17,195	9,294	8,803	6,314	22,719	10,891
2	20,714	15,922	4,862	10,654	10,362	21,446	21,068
3	21,875	21,992	25,418	11,799	9,290	26,355	3,884
4	14,561	16,256	13,374	8,477	6,840	20,619	3,764
5	15,303	10,222	1,317	6,398	7,040	15,747	17,449
6	7,228	13,664	14,025	8,273	8,529	18,027	8,656
7	2,125	4,045	10,800	8,962	11,418	4,475	19,915
8	10,538	1,455	11,468	11,662	14,118	3,183	22,615
9	31,020	12,105	7,946	14,180	13,153	17,771	37,011
10	8,369	5,262	3,886	1,620	4,076	10,768	14,225

...haul distances and transport-related fossil carbon emissions

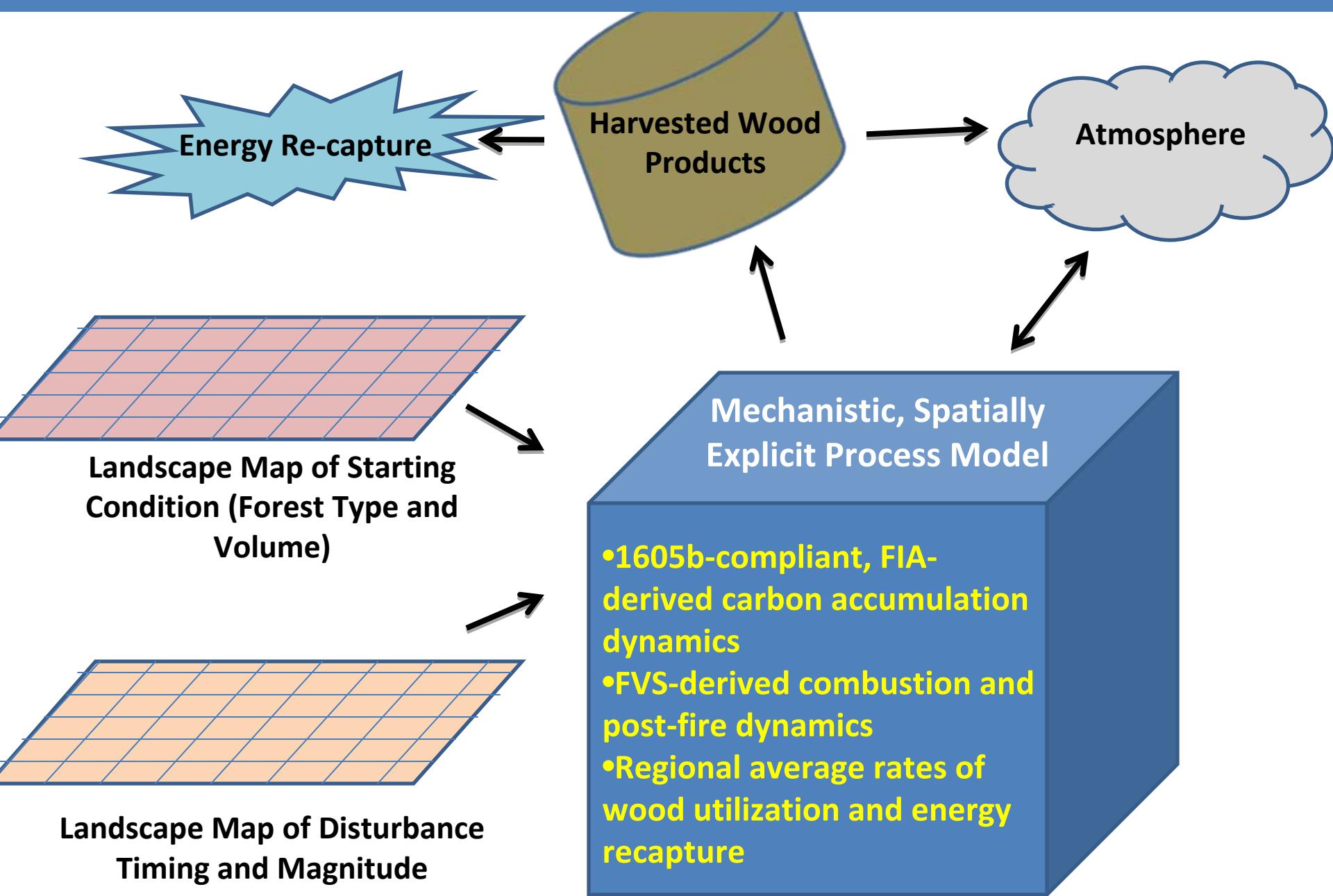


Fossil Carbon Emissions from Logging Trucks Hauling Ravalli County Timber

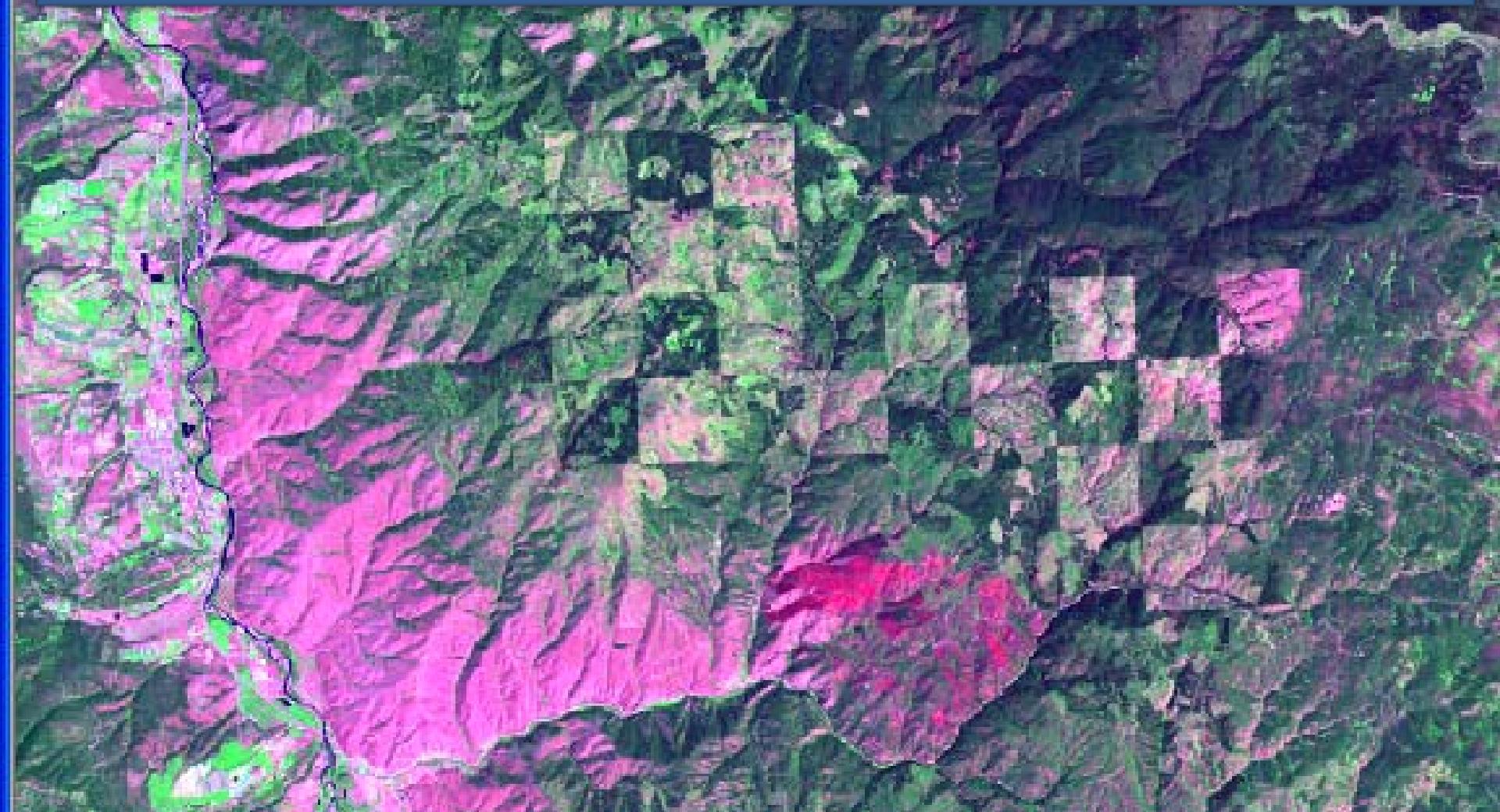


See: Healey, Morgan, and others, In Press, Carbon Balance and Management

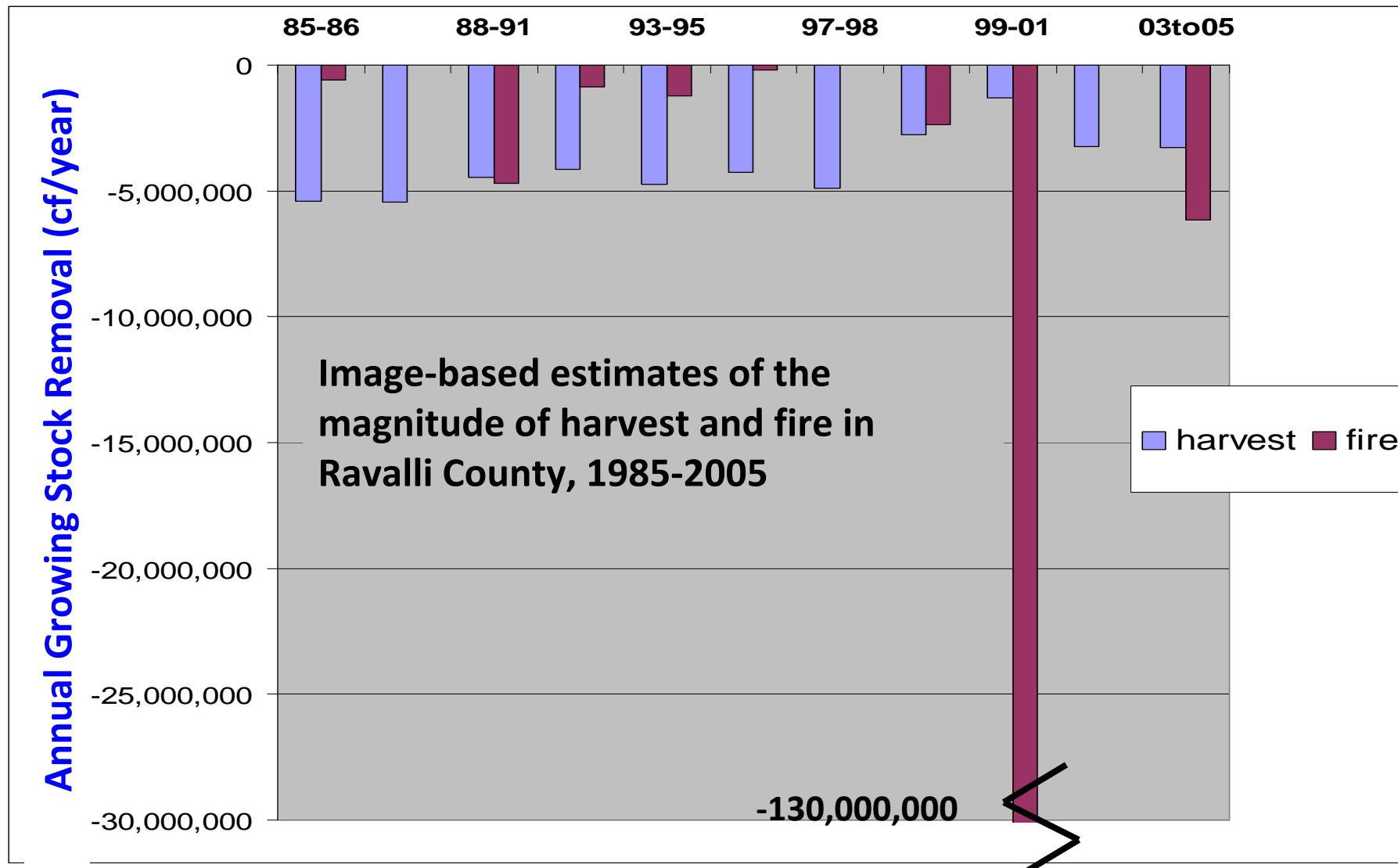
The Product Carbon Dynamics Module is part of a larger system



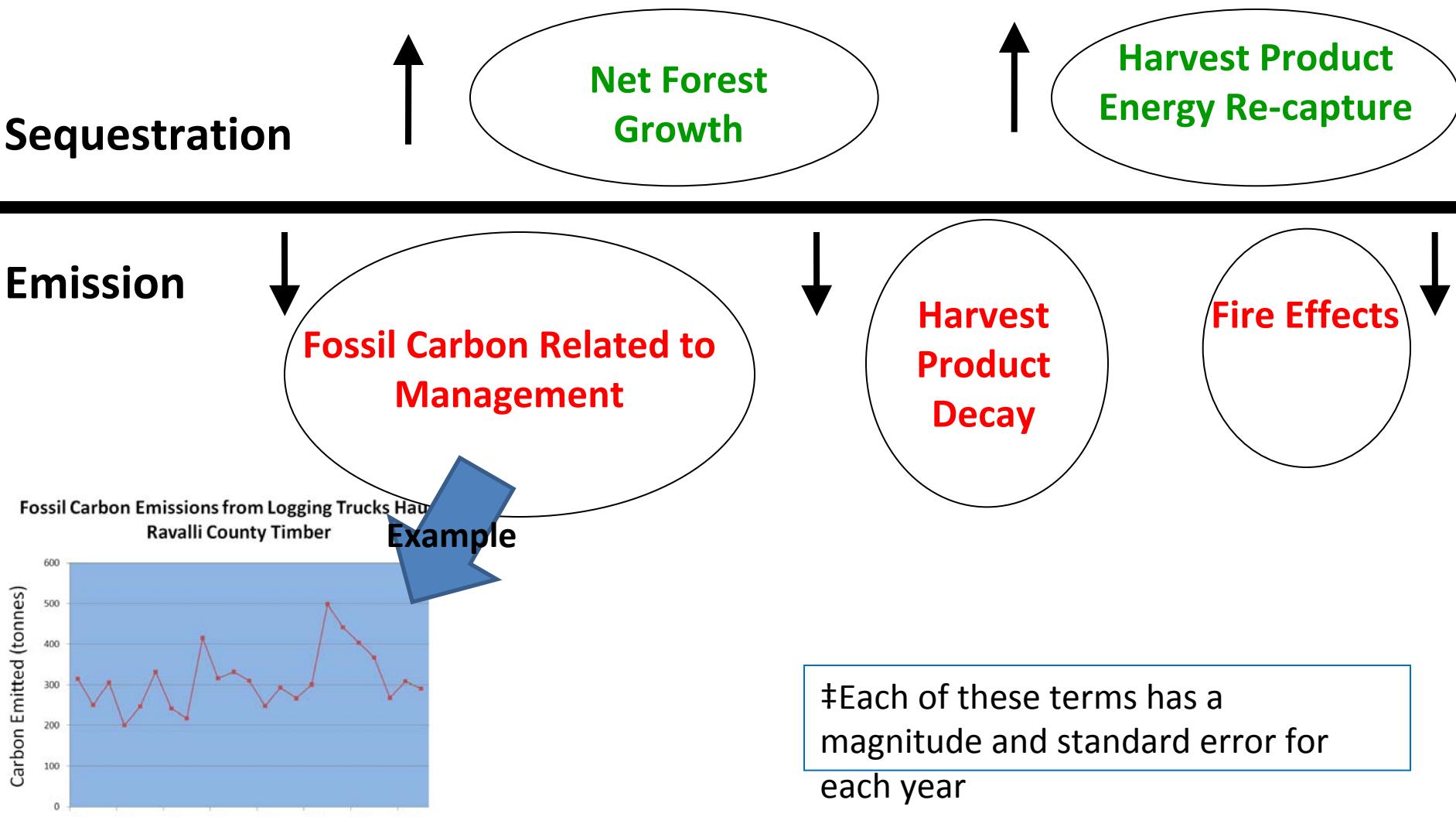
The system is mechanistic in that regional mean carbon accumulation rates are applied to undisturbed forest across the landscape from a remotely sensed starting condition.



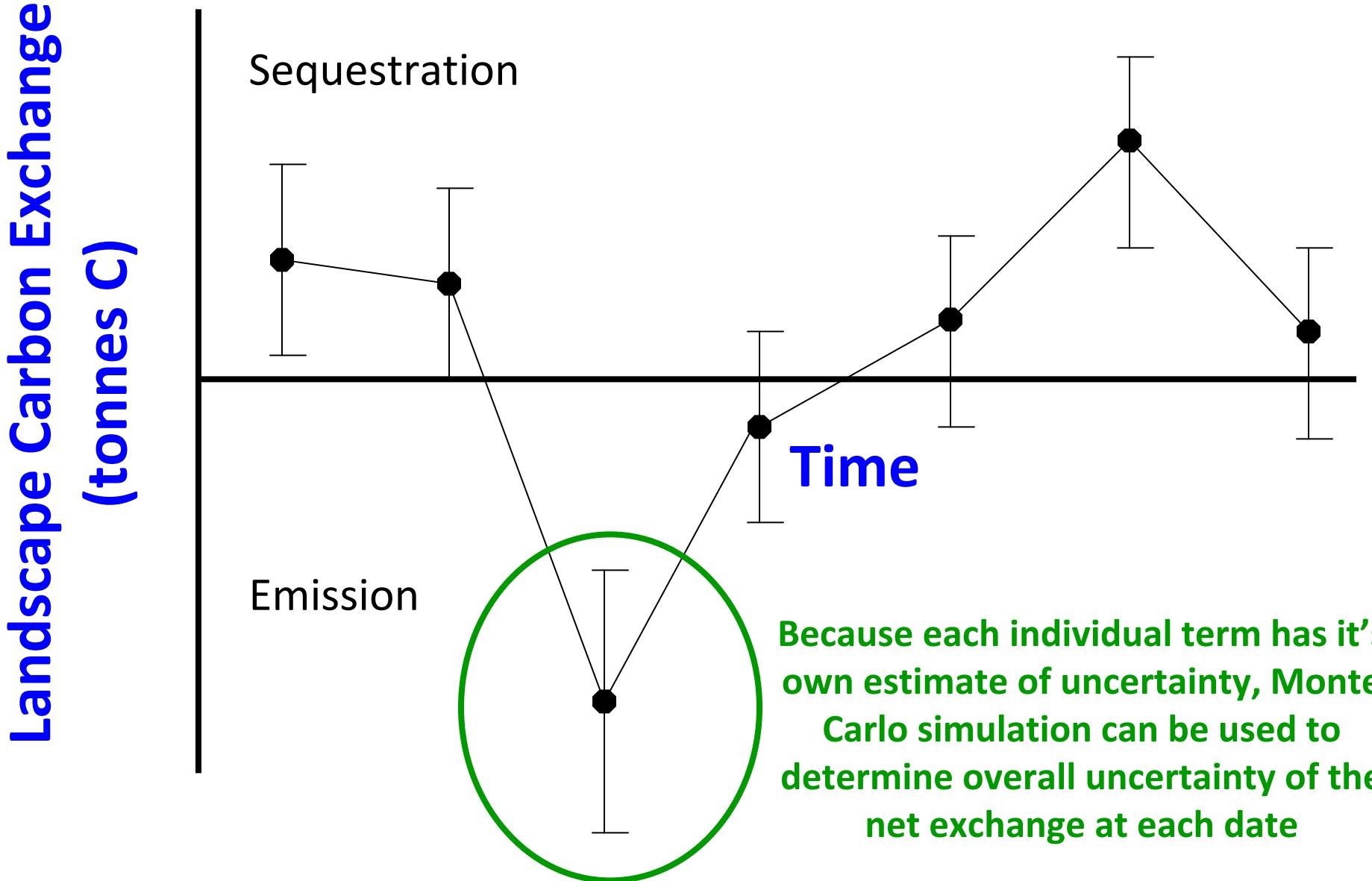
Mechanistic carbon accumulation is stopped and carbon stocks are reset only when disturbance is detected

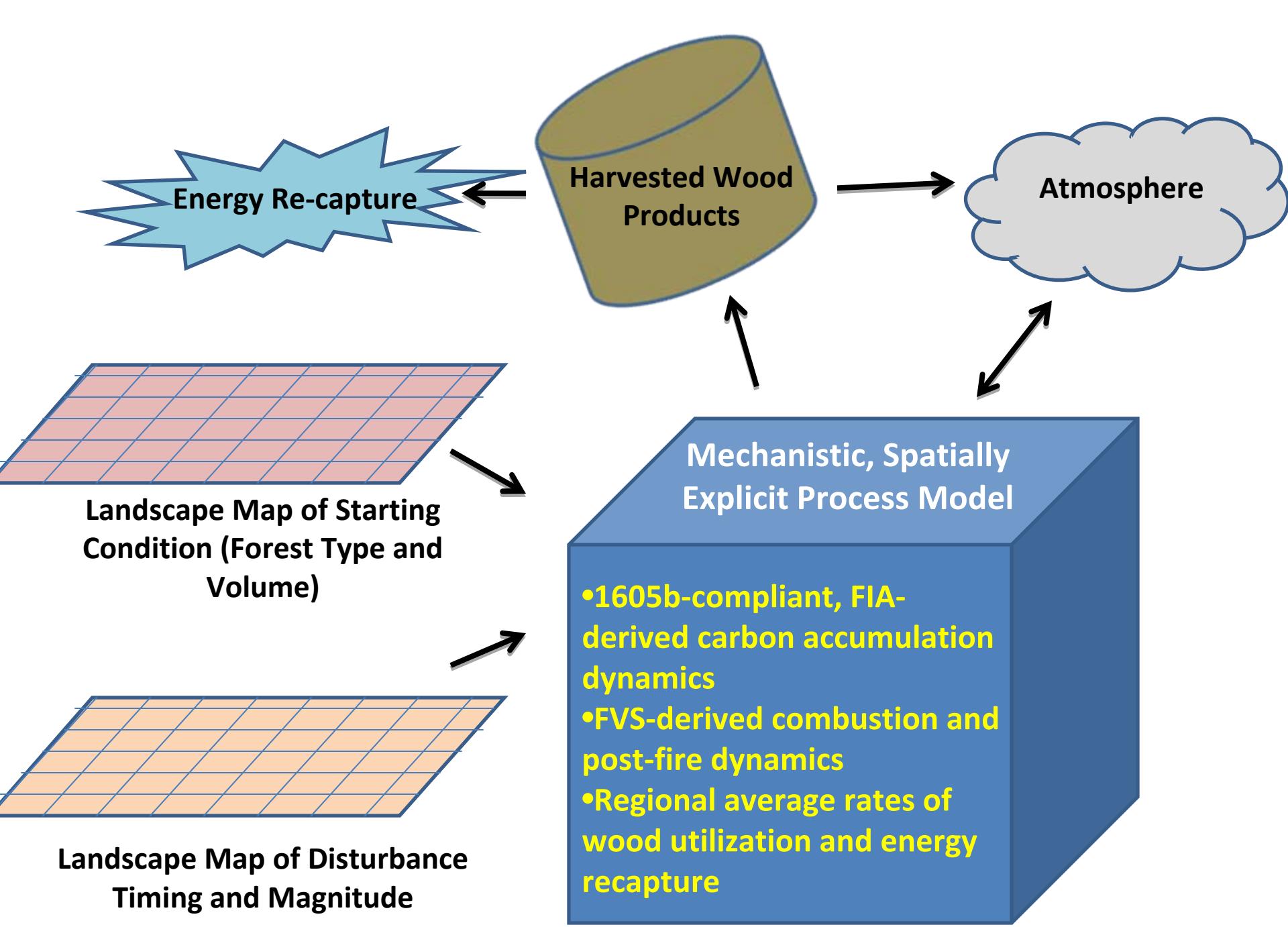


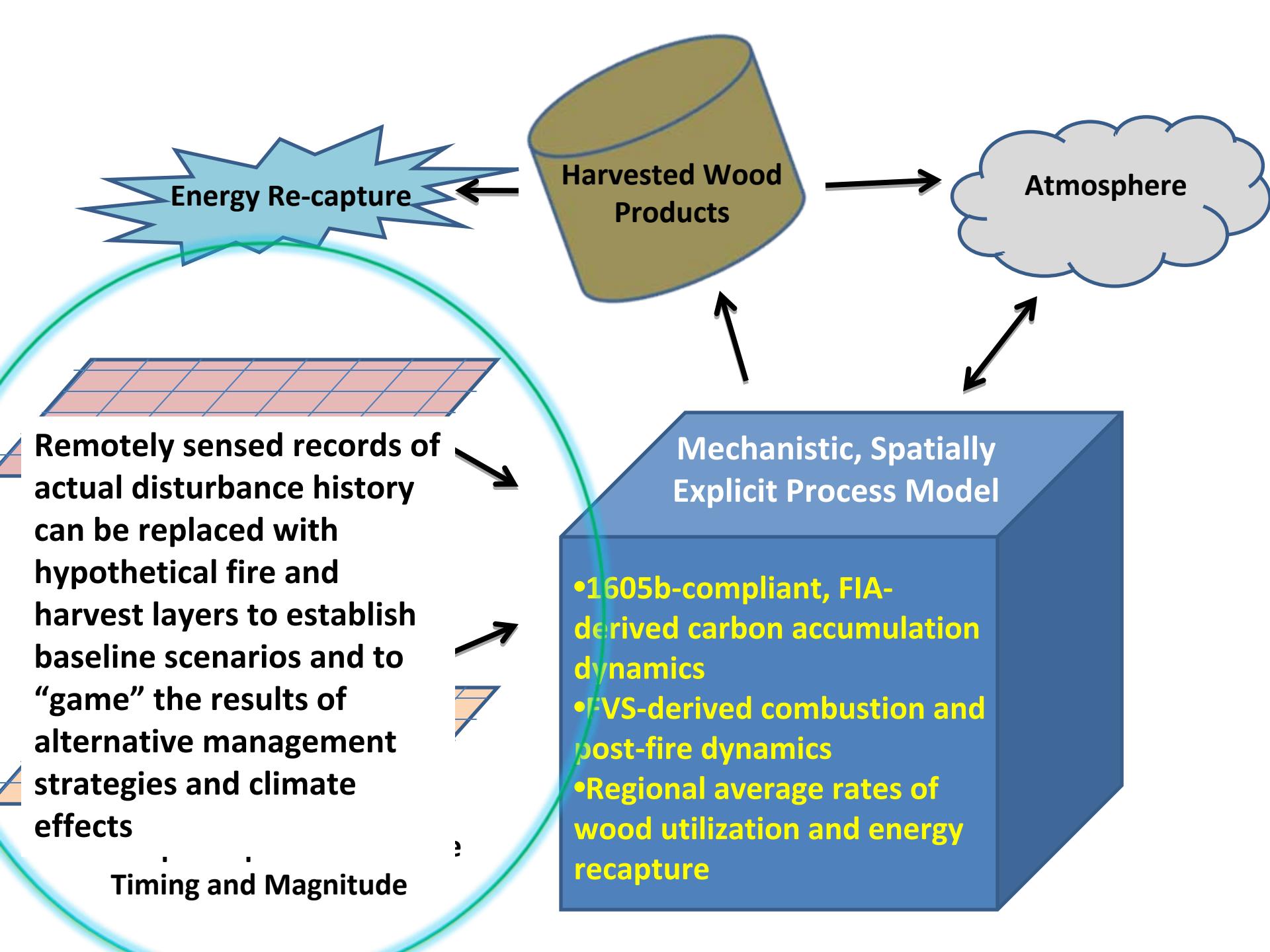
The result of the landscape carbon tracking system is that one can derive the relative impact of all of the processes being considered



When all of the net losses and gains are added together, we get a net landscape flux







seanhealey@fs.fed.us

todd.morgan@business.umt.edu